

# In a Moment's Notice: Surge Capacity for Terrorist Bombings

## *Challenges and Proposed Solutions*



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Centers for Disease Control and Prevention  
Coordinating Center for Environmental Health and Injury Prevention  
National Center for Injury Prevention and Control

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Division of Injury Response

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## Executive Summary

Explosive devices and high-velocity firearms are the terrorists' weapons of choice. The devastation wrought in two European capitals, Madrid and London, demonstrate the impact that can be achieved by detonating explosives among densely packed civilians. In an instant, an explosion can wreak havoc—producing numerous casualties with complex, technically challenging injuries not commonly seen after natural disasters such as floods, tornadoes, or hurricanes. Because many patients self-evacuate after a terrorist attack, and prehospital care may be difficult to coordinate, hospitals near the scene can expect to receive a large influx—or surge—of victims after a terrorist strike. This rapid surge of victims typically occurs within minutes, exemplified by the Madrid bombings where the closest hospital received 272 patients in 2.5 hours. Such a surge differs dramatically from the gradual influx of patients after an outbreak of infectious disease or an environmental emergency such as a heat wave, which can last several days to weeks afterwards. In addition, injuries to workers involved in recovery procedures can lead to a secondary wave in surge. The key question is this: Can hospitals meet the challenge?

Health care and public health specialists anticipate profound problems in adequately caring for the resulting surge of victims. Our current health care system, especially the emergency care system, is already severely strained by its routine volume of daily care.

Further, the health care system, emergency departments, and intensive care units (ICUs) of acute care hospitals are chronically overcrowded and resource-constrained. Without immediate federal assistance, many, if not most, communities would have difficulty caring for a surge of victims because each hospital and emergency medical service differs dramatically in capacity, training, and level of coordination. Indeed, a terrorist bombing in the United States would be a “predictable surprise.”

To address the challenges posed by such an event, CDC's National Center for Injury Prevention and Control (CDC's Injury Center) convened an expert panel in October 2005 and January 2006. The panel included experts in the areas of emergency medical services, emergency medicine, trauma surgery, burn surgery, pediatrics, otolaryngology, intensive care medicine, hospital medicine, radiology, pharmacology, nursing, hospital administration, laboratory medicine (blood bank), and public health. The panel was charged with identifying creative strategies that could be adopted in a timely manner to address surge issues from terrorism. The panel focused on recommending strategies for rapid management of large numbers of bombing casualties. They examined the related challenges that would confront not only the general emergency medical response and health care system, but would also affect select medical disciplines. Though developed in the context of a surge of injuries from a terrorist bombing, the recommendations in this report may improve the response to and management of a surge of patients from any cause, including biological, chemical, or nuclear.

This document, which is the result of the expert panel meetings, reflects the opinions and recommendations of the experts. It includes a description of system-wide and discipline-

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specific challenges as well as recommended solutions to address these challenges. The proposed solutions for the discipline-specific challenges have been incorporated into easy to use templates that can assist various disciplines in managing surge needs for injuries. The needs and resources of each community must be considered to effectively plan for a surge of patients into an already overburdened health care system. Admittedly, community resources are not specific to handling casualties of explosives, but the likelihood of this threat and the sudden demand it would place on the health care system make it imperative to manage deficiencies in surge capacity now—not when crisis strikes—and to do so in an aggressive, but thoughtful manner.

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## Background

Current patterns in terrorist activity increase the potential for civilian casualties from explosions. Recent events in Egypt, India, Iraq, Israel, Spain, and the United Kingdom clearly indicate that bombings targeting civilian populations are an ever-present danger worldwide. The U.S. Department of State reported 7,000 terrorist bombings worldwide between 1968 and 1999.<sup>1</sup> From 2001 through 2003, more than 500 international terrorist bombings caused more than 4,600 deaths,<sup>1-3</sup> excluding the attacks of September 11, 2001, which essentially used planes as flying bombs.

The U.S. Federal Bureau of Investigation confirmed 324 incidents of terrorist bombings in the United States between 1980 and 2001.<sup>4</sup> More than 21,000 bombing incidents (actual, accidental, attempted) occurred in the U. S. between 1988 and 1998.<sup>5</sup>

In 2005 alone, according to reports compiled from the Terrorist Attack Archives, Terrorism Research Center, 758 terrorist events were staged in 45 countries, and more than half (N = 399) were bombings. These events resulted in 8,019 injured persons and 3,049 deaths.<sup>6</sup>

Despite justifiable concerns about the dangers of chemical, biologic, or nuclear attacks, bombings with conventional explosives remain the terrorists' method of choice. Explosions, particularly in confined spaces, can inflict multi-system injuries on numerous patients and produce unique management challenges to health providers. Unlike the gradual influx of patients after events such as infectious diseases, the surge of patients after an explosion typically occurs within minutes of the event and overwhelms nearby hospital resources.<sup>7,8</sup> The potential for large numbers of casualties and an immediate surge of patients may stress and limit the ability of emergency medical services (EMS) systems, hospitals, and other health care facilities to care for the onslaught of critically injured victims.<sup>9-11</sup>

The ongoing and increasing threat of terrorist activities, combined with documented evidence of decreasing emergency care capacity, requires preemptive action. Health care and public health systems, individual hospitals and health care personnel must collaborate to ensure that strategies are in place to effectively receive, evaluate, and treat large numbers of injured patients; to rapidly identify and stabilize the most critically injured; to evaluate these efforts; and to strategically plan for future incidents.

### The Role of the National Center for Injury Prevention and Control (CDC's Injury Center) Centers for Disease Control and Prevention (CDC)

The mission of CDC's Injury Center, is to prevent premature death and disability and to reduce the human suffering and medical cost caused by injuries. This mission supports CDC's strategic goal to protect people in all communities from terrorist threats. As a means to prevent injuries and minimize the consequences of injury, the Injury Center uses the public health approach—a systematic process to define the injury problem, identify risk and protective factors, develop and test prevention interventions and strategies, and ensure widespread adoption of effective interventions and strategies.



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Many agencies have addressed issues of surge capacity for events such as biological attacks—most notably, CDC’s public health and laboratory surge programs and the Health Resources and Services Administration’s (HRSA) hospital preparedness program. To date, little effort has been directed toward increasing surge capacity in response to terrorist bombings. After in-depth discussions with HRSA, the Department of Homeland Security, the Federal Emergency Management Agency (FEMA), the National Highway Traffic Safety Administration (NHTSA), and CDC’s Coordinating Office for Terrorism Preparedness and Emergency Response, the Injury Center learned that CDC could play a unique role in identifying surge capacity issues related to terrorist bombings and proposing solutions. Furthermore, any solutions to enhance surge capacity in preparation for terrorist bombings directly apply to surge issues for other manmade or natural disasters.

To this end, CDC’s Injury Center convened an expert panel in October 2005 and January 2006. The expert panel was charged with identifying creative strategies that could be adopted in a timely manner to address surge issues from terrorism; in essence, identifying both system-wide and discipline-specific concerns and recommending feasible and affordable strategies for rapidly managing large numbers of bombing casualties. This document is the result of those meetings, reflects the opinions and recommendations of this expert panel, and includes its recommendations. These recommendations were designed for emergency medical, health care, and public health systems, with the caveat that immediate steps be taken to ensure an effective response. To kick off the process, the expert panel set objectives:

- Increase collaboration between CDC and federal agencies, external partners, and other experts on issues of surge capacity for injuries from conventional weapons.
- Identify factors that limit rapid assessment and treatment of injured patients in the field and at hospitals (including triage, availability of radiology, and access to operating theatres) and develop mechanisms to address these factors; and
- Develop a strategy and identify mechanisms to widely disseminate and implement findings from the expert panel (e.g., Web, print publications, and training curricula).

The panel represented a broad spectrum of medical care and administrative disciplines required to care for victims of a bombing. Panel members included personnel from emergency medical services; physicians specializing in emergency medicine, trauma surgery, burn surgery, pediatrics, otolaryngology, intensive care medicine, hospital medicine, and radiology; experts in pharmacology, nursing, hospital administration, and blood banking; and experts in public health. Expert panel members are listed in the acknowledgements section of this report.

## The Evolution of Terrorism

At the heart of, and as an impetus for, this meeting is the fact that terrorist attacks remain an ever-present threat. Terrorist events continue to occur globally and on an alarming scale. Bombings—the perpetrators’ method of choice—remain a real and constant threat, averaging two terrorist attacks per day worldwide in 2005.<sup>6</sup> In the past thirty years, terrorism has evolved from mostly secular, nationalist movements to diverse, multinational, global organizations.<sup>12</sup> These organizations have different motivations and tactics, and their bombings are increasingly lethal,<sup>13</sup> as witnessed in Madrid (March 2004), London

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(July 2005), and Mumbai (July 2006), terrorist efforts reveal an ever-increasing degree of sophistication, coordination, and capacity for harm.

## Lessons Learned in Madrid

In an effort to provide a framework to the meetings and subsequent discussions, the panel was presented with the example of the March 2004 Madrid bombings at the beginning of the first meeting. The Madrid experience provides a real-life scenario of what U.S. health care providers and systems must be prepared to confront: a complex, coordinated attack with thousands injured and a rapid surge of patients into surrounding hospitals. On March 11, 2004, between 0739 and 0742 hours, ten terrorist bombs detonated on four crowded commuter trains, killing 177 people instantly and injuring more than 2,000. Three hundred and twelve patients were evaluated and treated at Gregorio Maranon University General Hospital (GMUGH), 272 of them arriving between 0759 and 1030 hours. The Madrid response entailed multiple logistical and operational challenges, including field triage and transportation of injured persons; inpatient discharge; evacuation of emergency departments (EDs) and intensive care units (ICUs), and multiple surgical procedures and tests (hundreds of radiographs, computerized tomography (CT) scans, and ultrasounds). By 2100 hours that same day, 1,430 casualties had been treated at multiple hospitals; of these, 966 had been transported to 15 public community hospitals.<sup>14</sup> Panel members were asked to describe how their discipline would respond to the Madrid example.

## Terrorist Bombings in the United States: A “Predictable Surprise”

The reality of persistent, complex, global terrorist bombings, such as Madrid, make terrorist bombings in the U. S. a “predictable surprise.” The expert panel reviewed the characteristics of “predictable surprises” listed below early in the course of the meeting process, to provide background on common problems that could hinder effective surge response, and in an effort to identify concerns and issues that needed to be addressed within their recommendations.

The following characteristics of “predictable surprises” outlined by Bazerman and Watkins<sup>15</sup> apply to terrorist bombings and the U. S.:

***1. A shared trait of predictable surprises is that leaders knew a problem existed and that the problem would not solve itself.***

Reports of bombings occur almost daily. When—not if—terrorism returns to the U. S., our EMS and hospital systems will be ill-equipped to manage the consequences.

***2. Predictable surprises can be expected when organizational members recognize that a problem is getting worse over time.***

Terrorist events show no signs of abating. Between 2001 and 2003, more than 500 international terrorist bombings resulted in more than 4,600 deaths, as reported by the U.S. Department of State.<sup>13</sup> In 2005 alone, 758 worldwide terrorist events occurred, of which 399 were bombings. These events occurred in 45 countries and resulted in 8,019 persons injured and 3,049 deaths.<sup>6</sup>

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**3. *Fixing the problem would incur significant costs in the present, while the benefits of action would be delayed and ambiguous.***

A central issue in preparing for terrorist bombings in the U.S. is to proactively educate health care providers in the clinical management of bombing injuries. Education is expensive. Even if health care providers are initially trained to care for bombing-related injuries, unless these terrorist events become a more frequent and unfortunate reality, education must be repeated regularly to assure currency of knowledge and clinical competency. Another issue concerns the rapid push of clinical information immediately after an event. The mechanisms and capability to do this need to be developed and may be costly. Finally, many EMS systems and hospitals do not have capacity to care for patients beyond their usual volume; and some do not have capacity to care for the volume they now have, as evidenced by frequent ambulance diversions and lengthy delays for ambulances to off-load patients at hospital EDs. The cost of increasing facility capacity in the EMS and hospital systems may be substantial. Although increasing capacity will have immediate impact on daily operations in EMS and hospitals, the benefits of education and better systems for disseminating information will not be fully recognized until used in response to a terrorist attack or other disaster.

**4. *Decision makers often fail to prepare for predictable surprises because the natural human tendency is to maintain the status quo.***

Outside the military, our country's health care providers have little experience with terrorist bombings—particularly those capable of producing many potentially survivable injuries. Injury is the leading cause of death in the United States for persons between the ages of 1 and 44;<sup>16</sup> thus, many civilian health care providers, especially those in trauma systems, have vast experience in injury care, including incidents with multiple casualties. However, we have learned from the experiences of our military and international colleagues that clinical management of casualties from terrorist bombings differs considerably from that seen daily in trauma centers (e.g., blunt and penetrating trauma). To assume we can provide the same level of care for large numbers of victims from terrorist bombings as we do for victims of a bus crash is self-deceiving—a natural reaction is to maintain the status quo. Relying on traditional disaster management and trauma life support training is far easier and less expensive than learning and practicing new skills.

**5. *A small vocal minority benefits from inaction, and is motivated to subvert the actions of leaders for their personal benefit.***

No matter what the motivation, some people benefit from inaction.

**6. *Leaders can expect little credit for the prevention of predictable surprises.***

Advocating for and acquiring resources for terrorist bombing preparedness and response is challenging—especially when so many competing preparedness and response needs must also be met. With limited resources and the need for near-term results, leaders who prepare for events that may not occur can expect little credit for being proactive.

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# Surge Capacity Challenges

## System-wide Challenges

The threat of terrorism exists at a time when our hospitals and EDs are struggling to care for the patients who present during routine operations each day. Hospitals and emergency health care systems are stressed and face enormous challenges. Ambulances are routinely diverted from one facility to another. According to a 2003 report from the National Center for Health Statistics, 34% of U.S. EDs diverted ambulances from primary destinations; diversions occurred more frequently in metropolitan areas (50% of metro hospitals).<sup>16</sup> Emergency departments routinely operate above capacity. Sometimes, paramedics are forced to wait for extended periods before their patients can be transferred to hospital staff. Patients are evaluated and treated in ED hallways and held for hours, or even days, awaiting placement in an inpatient bed as hospitals struggle with high occupancy. In 2003, there were 113.9 million visits to EDs in the U. S., representing a 26% increase from 1993's 90.3 million visits. During this same period, the number of U.S. EDs decreased 14%.<sup>17</sup> The problem became worse in the 1990s when our nation lost 103,000 staffed inpatient medical surgical beds and 7,800 ICU beds.<sup>18</sup> Reductions in hospitals with EDs, regionalization of surgical care, increases in non-emergency patient visits to EDs, diversion of EMS, and personnel shortages have led to unprecedented crowding in EDs.<sup>19-23</sup> The Institute of Medicine recently released a three-part report highlighting the challenges facing our nation's emergency care system.<sup>24-26</sup>

This is the context in which we confront the growing threat of international terrorism. Hospitals are wholly unequipped to handle a sudden surge of highly complex injuries.

If a large-scale event (manmade or natural) occurs, health care systems and hospitals must be able to treat an immediate and potentially large influx of patients. A recent CDC publication determined that about three fourths of hospitals had disaster plans that addressed explosives, but few (one fifth) had actually conducted a drill involving imagined use of explosives.<sup>27</sup>

Issues affect the spectrum of injury care from prehospital through rehabilitation and also affect personnel from fire chiefs, trauma surgeons, and nursing supervisors to emergency medical technicians. Many problematic areas stand between the current reality of emergency care in the United States and the effective management of a Madrid-like event:

### ***1. Organization and Leadership***

Effective preparedness and response demand an established, functional leadership structure with clear organizational responsibilities. In many instances, particularly at a local operational level, such preparation has not occurred. Consequently, confusion over who has responsibility for specific actions will occur, increasing the potential for redundant efforts or gaps in decision-making.

### ***2. Alterations in Standards of Care***

Altering the standards of medical care provided in order to do the greatest good for the community is a concept and practice that is fraught with ethical, societal, and legal issues, making it difficult to surmount.

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### **3. Education**

Disaster preparedness and response education is not included in most medical or nursing school curricula; and, with the exception of emergency medicine, preparedness and response is not a requirement in residency training programs. Thus, most health care providers are not prepared to handle clinical care during a disaster. As standard curriculum, emergency medical technician (EMT) paramedics are required to complete a module on “medical incident command.” Yet EMT-Intermediates and EMT-Basics do not always receive this essential training. A well-linked educational process for those involved in mass casualty disaster preparation and response is not yet available.

### **4. Communications**

Effective and timely communications are essential to functional command and control; admittedly, communication failure (prehospital, hospital, and public) is a recurrent theme during and immediately after a disaster.

### **5. Transportation**

Coordinated transportation service is vital and often, timely and effective use of mutual aid transport units to transport or transfer patients to tertiary care is challenging. Additionally, there is currently no comprehensive plan for disaster response which effectively integrates civilian with military medical transport resources.

### **6. Infrastructure and Capacity**

Communities differ in their capabilities and infrastructure to handle disasters in the prehospital and hospital arenas. Regardless of a community’s capabilities and the level of coordination between resources, those injured from an explosion will rapidly seek care from or will be transported to the nearest hospital,<sup>28</sup> and may not seek care at the facilities designated by existing response plans. Thus all communities need plans that have been successfully and repeatedly drilled. Additionally, facilities vary in capabilities and staffing. Any facility, whether it offers tertiary (i.e., specialty) care or community, rural, or alternate care, will undoubtedly face problems in several areas:

- *Personnel*

Shortages of qualified personnel, including nurses and specialized technicians, exist throughout our health care system. During a mass casualty event, these shortages could manifest to catastrophic levels. Some staff may not respond during a bombing or other disaster event for various reasons, including fear for personal safety, family issues, or injury. Estimating available staff may be difficult because many work at multiple facilities. Conversely, the screening, managing, and credentialing of well-intentioned volunteers during a disaster can be challenging, if not impossible.

- *Equipment and supplies*

Shortages of essential equipment and supplies often occur in the aftermath of a large-scale terrorist bombing or natural disaster. Moreover, most facilities in a given region use the same suppliers for back-up stock and equipment (e.g., pharmaceuticals, general medical supplies, ventilators).



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- *Information technology (data management/data systems)*

Oftentimes, software systems involving EMS services, hospitals, and health departments are incompatible. To maximize patient outcomes and allow family members to quickly locate loved ones, a data management system must have the ability to track patients from the scene to the hospital, track patients throughout the facility, and track transfers to other facilities.

- *Cost*

Preparation and incident mitigation requires a commitment of resources. Training prehospital providers, stockpiling key equipment such as stretchers and reserving capacity in the blood supply will be expensive.

- *Interoperability*

An effective medical response to a terrorist bombing demands that the response system components (personnel, organizations, and command structures) are interoperable. Yet services, agencies, and systems are not integrated for maximum efficiency (i.e., equipment; preparation; communications; and incident command, both prehospital and hospital).

## **7. Potential Bottlenecks**

Despite the impact of these events on multiple areas of clinical care, there are some areas whose response and capability may impact patients across the spectrum of care:

- *Radiology*

Given the nature of injuries related to terrorist bombings, the most victims will undergo multiple radiology studies. In Madrid, 350 radiology studies and interventions were performed the day of the bombing.<sup>14</sup> The numbers of patients requiring studies may lead to a bottleneck, and hinder the institution's ability to streamline care. However, to date, professional radiology societies have not focused on surge capacity for bombing victims and the potential for radiology to become a bottleneck. Instead, they have focused exclusively on detection and treatment of radiation emergencies and disasters.

- *Critical Care*

If a terrorist bombing increases the demand for critical care/ICU services which, in turn, exceeds reserve ICU capacity, hospitals would have limited ability to divert or transfer patients to other hospitals and will need a plan in place to provide emergency mass critical care.

- *Pharmacy*

Ensuring an adequate supply of required pharmaceuticals throughout the institution, and community, is essential, and may prove challenging. This may be complicated by the fact, as noted above, that many facilities in a given region use the same suppliers for back-up stock and supply.

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## 8. *Triage*

Our current planning and preparedness activities assume that prehospital providers will be dispatched in coordinated fashion, will arrive on the scene to triage patients, and will transport them to the appropriate facilities, thereby preventing any component of the system from being overwhelmed. In many disasters, however, most victims self-transport or are transported by other laypersons. Victims do not wait for an organized field triage system to come into effect; consequently, the system or facilities are overwhelmed.<sup>28</sup>

## 9. *Legal Issues*

Multiple legal issues impact the response to a terrorist bombing or other major disaster, and may impact effective, coordinated medical care that optimally utilizes all of a community's resources. Examples include credentialing of providers; altered standards of care; standards for clinical documentation; the Emergency Medical Treatment and Active Labor Act (EMTALA), the Health Insurance Portability and Accountability Act (HIPAA), or Clinical Laboratory Improvement Amendments (CLIA).

## Discipline-specific Challenges

Each of the aforementioned problems has an impact on the spectrum of care; however, unique examples exist for many disciplines. The expert panel also identified the following discipline-specific challenges and provided feasible and affordable strategies for effectively addressing surge capacity. (The proposed solutions are provided in a template format at the end of this document.)

### 1. *Emergency Medical Service Response*

As initial responders, EMS providers and personnel must confront several issues, including:

- *Personal protection*

Currently, there is no unified approach to protect rescuers or stage a response. When do appropriate concerns for scene safety and the potential for secondary explosive devices hinder the initial response?

- *Decontamination*

Though treatment will be delayed, decontamination may be imperative. Uniform policies and protocols for decontamination of personnel and patients need to be established for all scenarios (e.g., weather, bombing).

- *Incident command*

Interoperability between prehospital and hospital command structures is a challenge. This challenge manifests not only in the technical aspects of radio interoperability, but also in the interdisciplinary aspects of communications plans. A unified incident command structure must be incorporated into health care and EMS practice; further, EMS must be designated as part of the field response command structure.

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- *Field triage*

Although multiple triage systems are used across the country, there is no agreed-upon methodology for field triage during a disaster.

- *Destination decisions*

Determining the appropriate destination in the aftermath of an event may be difficult, especially if the initial scene “size-up” has not been performed.

- *Hospital evacuations*

Whenever EMS transfers patients from hospitals to free up acute care beds, normal hospital functions are adversely affected.

- *Sustainability of operations*

Providing personnel with needed support (e.g., physical, emotional) and maintaining facilities, equipment and supplies in the aftermath of an event is an ongoing challenge.

## **2. Emergency Department Response**

The emergency department (ED) is a central portal to any hospital; as such, the ED is where initial information about a disaster is communicated. The challenge is to determine the magnitude of the event and initiate the appropriate institutional response. This response must be in concert with the assessed magnitude, including decisions to declare an institutional disaster, to declare an institutional lock-down, and to determine if recipient victim decontamination is needed. To determine the extent of the response, the quality and quantity of information from the field and between the regional emergency operations center and hospital is critical. Frequently, information challenges and communications are a source of failure.

In a large-scale event, each hospital must have the capability to increase staffing, rapidly assess its available bed status, and make occupied beds available—especially in the ED, operating theatres, and critical care units. To free up beds, hospitals should cancel elective surgeries and admissions, open traditionally non-patient hospital areas for patient care (e.g., classrooms, offices, etc), and begin early discharge for inpatients as appropriate.

During a mass casualty event, transfer of patients to an alternative care site may be delayed due to the time, personnel, and equipment needed to set up that site. However, development of an alternative site will, over time, free up non-critical care beds.

Key issues follow:

- *Ascertaining the validity and scope of the event.* Notification is essential to activate and implement an appropriate response; information/updates must be consistent and frequent.
- *Incident command.* A Hospital Incident Command System (HICS) must be implemented within the ED, hospital, and community. HICS is a widely used emergency management system known for providing a chain of command that can mobilize at a moments notice, provide accountability of position functions, allow flexible responses to emergencies, improve documentation



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of facility actions, provide a common language to facilitate outside assistance, and develop prioritized response checklists for senior leadership. Each hospital should be part of a regional unified command structure.

- *Discharging patients from the ED.* To free up resources, patients should be discharged, or transferred to other areas for care.

### **3. Surgical and Intensive Care Unit Response**

Multiple factors affect trauma surgery and its preparedness and response to a bombing event or natural disaster.

- *Changes in surgical practice*

The recent increased interest in disaster response capabilities is in contrast to the general surgery community's decreased interest in managing emergency surgery. Thus, the knowledge base and skill set to manage a Madrid-type scenario is being concentrated at fewer hospitals. Many hospitals with the capacity to handle surge, as it relates to beds and staffing, have little technical capability to manage a surge of patients from a bombing.

- *Time of day*

As in the Madrid bombings, the time of the event is critical for trauma centers and community hospitals. However, disaster planning often does not consider time of day. At 0200 hours, for example, a community hospital may not have operating theatre capability.

- *Limited ICU beds*

Overcrowding may require decisions to delay surgeries, identify beds in other areas of the hospital, and/or transfer patients to another facility.

- *Loss of excess capacity/Capacity on a given day*

The U.S. health care system has systematically and deliberately eliminated capacity because unused capacity is an additional expense.

- *Education*

More surgeons, especially those in trauma centers, need further education on the planning and response process. The U.S. military in Iraq has successfully demonstrated concepts in surgical surge capacity management that should be translated immediately to civilian medicine. Further, Iraq's experience with damage-control (emergency) surgery has shown that more patients' lives can be saved through temporizing damage-control surgery than if patients received time-consuming definitive surgery.

Additionally, after a terrorist attack, critical care and ICU services will be needed to treat the seriously ill or injured casualties. The emergency mass critical care plan should address hemodynamic resuscitation and support using intravenous fluids and vasopressors; administration of antibiotic and other disease-specific countermeasures; prophylactic interventions to reduce adverse consequences of critical illness; and basic modes of mechanical ventilation, and should include:

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1. Interventions that improve survival; without which death is likely;
  2. Interventions that do not require extraordinarily expensive equipment; and
  3. Interventions that do not consume extensive staff or hospital resources.

If ventilators are unavailable to treat all patients in need, minimally skilled individuals could use an endotracheal tube to manually ventilate the patient. Critical care areas should be equipped to measure, at a minimum, oxygen saturation, temperature, blood pressure, and urine output. When critical care/ICUs are full, hospitals can create additional capacity in non-ICU rooms concentrated on specific wards or floors. Patient care areas that already contain equipment similar to ICU's (endoscopy and surgical suites) are good alternatives, but these ad hoc critical care areas will increase capacity only slightly and require cessation of services normally provided.

When a hospital cannot meet increased demand for critical care services using its existing critical care practitioners, a two-tiered staffing model comprising noncritical care physicians and nurses may be substituted. Members of the Working Group on Emergency Mass Critical Care (Center for Bioterrorism at the University of Pittsburgh) and the Society of Critical Care Medicine concluded that a critical care physician can supervise up to four noncritical care physicians who can each manage up to six critically-ill patients. They also concluded that a critical care nurse could supervise up to three noncritical care nurses with each caring for up to two patients. In this model, a hospital's critical care staff is multiplied to where one critical care physician could oversee the care of up to 24 critically-ill patients, and one critical care nurse could oversee the care of up to six critically-ill patients.<sup>29</sup>

Additionally, many of our nation's leading children's hospitals with large Pediatric Intensive Care Units (PICUs) operate at maximum capacity. If a mass casualty involving children and infants were to occur, the PICUs' response and ability to provide intensive care would be severely constrained.

The emotional issues surrounding the care for a dying or dead child compounds this issue as paramedics, physicians, and others generally do not want to pronounce children dead at the scene. Thus, they will transport a child who has been pulseless and apneic for an hour, and still hopelessly receiving CPR, to the ED and ultimately to the PICU where the child will be declared deceased. Such considerations affect field triage and care in a mass casualty situation. Finally, PICUs have a chronic shortage of trained, available, and experienced staff.

#### **4. Radiology Response**

Whereas in many areas (ICU beds, operating rooms, ventilators, etc.) the United States has diminished capacity, it has, in fact, a slight surplus of capacity in radiology, which would be beneficial in managing multiple bombing victims.

Administrators have learned that hospitals lose money when patients wait in an ED or hospital due to insufficient radiology capacity. For this reason, hospitals have invested in imaging technologies such as computed tomography (CT), magnetic resonance imaging (MRI), ultrasound, and digital imaging. Radiology capacity has increased and improved technologies are now widely used. Still, relatively few

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U.S. hospital centers and health care systems have enough capacity and ability to maintain sufficient staffing levels to effectively use this equipment. Each hospital differs in its capabilities, equipment, and personnel (technicians and radiologists). Additional problems may include preserving radiology for the most appropriate, critical patients; ensuring immediate access to backup components of critical equipment; and interacting with vendor technicians.

## **5. Blood Bank Response**

In the last 30 years, the United States has experienced only five disasters in which more than 100 units of blood were used. If a large-scale terrorist bombing took place, large amounts of blood would be needed only if many victims were seriously injured.

The blood banking community has formed an interorganizational task force to address blood needs in the event of a disaster. The AABB (formerly known as the American Association of Blood Banks) Interorganizational Task Force on Domestic Disasters and Acts of Terrorism (AABB Interorganizational Task Force) unites national blood organizations representing virtually all the nation's blood centers (AABB, America's Blood Centers, and American Red Cross) and hospital and supplier associations with liaisons from the Department of Health and Human Services, Food and Drug Administration, CDC, and Armed Services Blood Program to coordinate efforts in preparation for and response to disasters affecting the blood supply. Potential issues with our nation's blood supply follow:

- *Disruption of the blood supply system*

Lack of blood will probably not be a problem, but disruption or interference of the blood supply system could wreak havoc. During times of disaster, including terrorist attacks, Americans will search for ways to help. Potential donors will descend on hospitals and blood centers and quickly overburden the system. Blood collection, processing, and testing are highly regulated procedures in a technical system that requires trained staff. On September 11, 2001, New York and New Jersey used 224 units of blood, while Washington and Virginia used 34—totaling 258 units, all of which were on the shelf before the disaster occurred.<sup>30</sup> Across the nation, more than a half million potential donor's volunteered blood.

In the event of a disaster, the AABB Interorganizational Task Force will inform the American public if blood donations are needed and tell them how and where to donate. In most instances, the appropriate message is that additional blood is not needed immediately after the disaster, but that individuals should contact their local blood centers to schedule a donation in the upcoming weeks.

- *Transportation of blood*

Even when blood products are not shelved at the surge capacity site, the products can be available in hours. In fact, blood can be transported to a disaster location faster than donations can be processed. There are some issues with transporting blood; for example, authorization may be required to transport blood around the state or country. In addition, blood centers may

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have difficulty obtaining diesel and unleaded fuel to power generators or to operate staff vehicles that transport blood. Federal, state, and local emergency preparedness offices need to make blood products a priority for obtaining transportation and fuel.

- *Local organization*

In a disaster, blood needs to be placed exactly where it is needed—at the hospitals serving the large influx of patients. Few hospitals regularly collect blood; fewer still are capable of handling an influx of donors while caring for disaster patients. In some metropolitan areas, hospitals may be served almost entirely by one blood center; in other areas, hospitals might get blood regularly from several sources. Planned and coordinated efforts are needed during a disaster to know which blood centers will service the hospitals at surge capacity. Within an hour of a disaster, the AABB Interorganizational Task Force will convene a conference call of national blood organizations, HHS, and local affected blood centers to determine local needs for blood and actions necessary to meet those needs. The Task Force will meet again hours or days later to coordinate subsequent blood-related efforts.

- *Staff who can administer blood*

Most hospitals aim for a three-day supply of blood. If blood is not stored at the hospital; typically, the blood can be readily accessed. For a hospital to consume a three-day blood supply in three hours is highly unlikely. Instead, the hospital may have too few trained staff to administer blood. Several documents are available to assist blood centers, hospital blood banks, and transfusion services prepare for and respond to disasters and acts of terrorism that could affect the blood supply.<sup>31-33</sup>

## **6. Hospitalists' Reponse**

By the end of this decade, there will be more hospitalists (physicians or internists caring for hospital patients) than other medical subspecialties; currently, half the hospitals with 200 or more beds employ hospitalists. Although they may not be directly involved in the care of casualties from a terrorist event, hospitalists will be vital in rapidly discharging inpatients, accepting transfers from ICUs, and freeing bed space for victims.

## **7. Administration Response**

When an institution is stressed clinically, it will also be stressed administratively. Hospitals face formidable challenges in the post-911 era. Shrinking revenue margins put pressure on budgets and complicate investment decisions to purchase items for contingency operations. Unlike nations with publicly funded health systems, the U.S. health care industry must support its contingency investment needs by pooling a mix of private funding with local, state, and federal resources. As a result, every hospital has some capability, but the clinical and administrative capabilities of each vary widely.

The United States has 4,919 community hospitals, of which 221 are major teaching hospitals. The major teaching hospitals are components of academic medical

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centers, often include a Level 1 trauma center, and may coordinate local EMS transport. These 221 hospitals are the focal points of graduate medical education, technology, and tertiary services. Should an incident occur, these hospitals will be expected to serve the local community, through either direct clinical care or system coordination. Maintaining these hospitals in the face of falling revenue margins strains the ability of any organization to support infrastructure for “response capability.”

The rest of the hospital industry is similarly stressed. Total staffed beds in the United States have dropped to just below 956,000. Outsourcing outpatient services and procedures to non-hospital settings further reduces revenue. Less money means less opportunity to invest in hospital infrastructure, which gradually erodes sophisticated diagnostic services in hospitals and complicates our nation’s health care industry from responding in traditional ways, let alone under extraordinary circumstances.

Within each community, leadership from the health care industry is a key element in an effective response. Hospital executives recognize that major events will activate political and law enforcement leadership and that they must be proactive and form professional and collegial contacts with community leaders. Similarly, hospitals must be linked to provide mutual aid and assist patient transfers. Businesses function on increasingly narrow inventory levels, and hospitals in the same community usually rely on the same suppliers. In a crisis, suppliers will resort to rationing inventory. Regional and multistate mutual aid plans should be developed; but in catastrophic events, help from those outside the affected zone may take days to arrive, underscoring the need to identify resources to support three days of operations before reordering supplies.

Hospital responses to mass casualty events are often chaotic. In part, this is due to lack of training and experience, but the disorganized response is compounded by not having an appropriate command structure such as the HICS. Use of an appropriate incident command system does not guarantee a successful response, but without one, failure is almost certain. Hospital personnel need to understand the concept of regional unified command and be willing to participate appropriately during a disaster.

When a situation demands swift action, hospital administrators have to focus on many areas simultaneously. Using a step-by-step approach, administrators can bring some order to chaos and, in fact, improve response times and save lives. Administrators should focus on the critical areas listed below:

- *Control of the external environment*

The external environment will change rapidly during a large event. Maintaining control of hospital grounds (e.g., facility security and traffic) is essential. Clearing beds to accommodate incoming casualties, redirecting nonemergency patients to other resources, and managing overall comings and goings of staff will require effective control of the external environment, including media control.



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- *Implementation of Hospital Incident Command System*

In a fast-paced disaster like the Madrid bombings, it is of crucial importance to have identified the appropriate decision-makers beforehand for the HICS. In a crisis, there is little time for meetings or discussion about the appropriate use of support functions and personnel.

- *Personnel Issues*

There should be a balance between the individual needs of staff and the organization as a whole to assure adequate coverage for short- and long-term medical responses. Decisions must be made early about when staff can go home to check on family members or what to do if staffers leave in the middle of the response. A method to request additional staff on short notice coupled with defining an individual institution's surge capacity can assist in finding the right mix of clinical and nonclinical support to handle the increased workload.

- *Memorandums of Understanding or Agreement*

Prescribed agreements to share supplies, personnel, or equipment should be written and drilled to support local, regional, and state partners in time of need.

- *Logistics and supplies*

Coordination with key suppliers and maintenance of inventories throughout the health system will make ramping up the level of effort easier. Depending on the event, some areas (i.e., obstetrics, outpatient surgery, and various clinics) may not be directly affected and could provide supplies. Effective logistics management would also include patient transportation to and from appropriate care settings. Although the housing of evacuees is a municipal function, knowing the locations of designated Red Cross shelters throughout the vicinity and transportation resources for low-acuity patients and their family members will hasten discharge planning and improve patient flow in the ED.

- *Alternate care sites*

A hospital is most effective when it can mobilize quickly and expand care to the city's walking wounded. Triage systems are typically used to prioritize patients so that low-priority patients can be directed from the main hospital, thus allowing ambulances and hospital staff to focus on high-priority patients (i.e., burns, dehydration, multiple injuries). Alternate sites may allow large health systems to facilitate triage and direct patients and families to appropriate sources of care.

- *Credentialing*

The Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) emergency credentialing system does work, but it must be tested within an organization before it is needed. State Emergency Systems for Advance Registration of Volunteer Health Professionals (ESAR-VHP) reflect JCAHO requirements and provide a standardized set of verified credentials for

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volunteers who may be called to assist hospitals during emergency situations. Many aspects of staff credentialing and privileging can be streamlined, but the formal enrollment cannot be circumvented. In most hospitals, formal enrollment provides access to entering orders, prescribing modalities, writing prescriptions, ordering laboratory tests, and documenting care using automated systems. No matter whether credentialing is handled by human resources or a professional staffing office, the design of the system should support the use of volunteers in nonclinical activities.

- *Patient tracking*

Tracking patient movement is a critical function during any mass casualty situation. Successful tracking begins at the point a patient enters the health care system. When more time is spent identifying and tracking patients, the prospect of reimbursement for related costs is better. The ability to track patients, identify their supply consumption, and monitor bed use enables senior management to proactively meet the needs of health care providers on the frontline. Many patient tracking systems exist, and if at all possible, the system should allow automated tracking for exercises and real disasters.

This list is not all encompassing for every facility. The staff of any health care organization should periodically evaluate areas like plant management, social work resources, safety, materials management, biomedical equipment and repair, service procurement, and patient admittance to help prepare for the unexpected. Often, disaster preparedness is focused solely on the transfer of care between provider and patient and not on the infrastructure to support the effort.

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# Surge Capacity Solutions

## Addressing System-wide Challenges

How do we address acute events that stress our overburdened system? Apparently, we must prepare for the predictable surprise—a bombing—which is the most common form of terrorist attack. The United States has a basic, functional capability to respond to the surge of patients following a terrorist event such as a bombing; however, several critical areas must be addressed for effective surge capacity to occur. To address the system-specific challenges related to surge capacity that are highlighted above, the expert panel outlined the following recommendations for each challenge.

### **1. Organization and Leadership**

Leadership is important for successful preparedness and response at all levels—field, hospital, city, state, and federal—and it is mandatory in the planning and response phases.

### **2. Alterations in Standards of Care**

Culturally, the United States may need to revise its stance on health care. Instead of doing the greatest good for the *individual*, we may need to do the greatest good for the *community* (i.e., save the most victims). There is, however, no universally accepted methodology of doing this, and the process is fraught with ethical, societal, medical, and legal issues. A protocol is needed to determine when and how to deviate from the norm without the civilian health care provider or facility experiencing repercussions. An altered protocol would improve the civilian sector's ability to manage patient assessment, treatment, flow, and outcomes for the greatest number of patients. It is clear that changing standards of care will require efforts to preserve quality of care, a formal process in each community to determine when and how to transition from standard operating procedures to an altered standard of care, and determining who will have the authority to order the transition. In August 2004, the Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services (HHS) convened a panel of experts to examine the complex issues surrounding alterations in clinical care. Their findings are published in the monograph *Altered Standards of Care in Mass Casualty Events*.<sup>34</sup>

The rationale for suspending standards of care in an emergency is that more patients will survive a terrorist attack if key interventions are provided to the greatest numbers of casualties likely to benefit from receiving care. Hospitals and EMS systems at surge capacity will require autonomy to suspend regular standards of care and shift to emergency critical care practices.

- Although care can be altered at the institutional level, if all hospitals affected by a crisis switch to emergency critical care practice standards at the same time, more patients will receive effective care.
- The ethical, political, legal, regulatory, and logistical implications of suspending standards of care and triaging patients to limited resources will require the participation of state and federal government. Legislation will be required to suspend standards of medical practice during an emergency without practitioners and hospitals incurring legal liability.



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- A mechanism is needed to address issues associated with change from routine to altered (emergency) standards of care/sufficiency of care.
  - Community education before, during, and after an event is necessary for acceptance and understanding.

### **3. Education**

Educational efforts must include an all-hazards approach that addresses the most likely, predictable terrorist event: a bombing. The education given to care providers should reflect the potential severity of the event. Training must be standardized across all levels of providers so that there is consistency among the disciplines. Training should address clinical care and systems issues.

### **4. Communications**

Communication plans should include interoperable, redundant regional emergency communications systems, ideally with multi-frequency bands, and trunked systems with the capability to pool user groups (for example, among hospitals) via the incident command structure. If a catastrophic incident results in massive power failure, emergency backup systems, such as mobile satellite telephones, will be needed along with other conventional methods of communication. Communication plans also should address command and control structures and disaster crisis counseling.

Informatics and data systems link information for real-time impact (i.e., which hospitals have beds, where patients can be diverted, how to find loved ones, and how to access survival data). Without patient tracking and informatics, no one will be able to evaluate what works and what does not work in a given situation.

### **5. Transportation**

The military is probably the only group with the capability to transport patients on a large scale; however, not on short order, as it may take hours to arrange a single transfer. Regional, statewide, and national plans and agreements should address the roles of National Guard and active-duty military personnel for providing large-scale air medical resources on relatively short notice. There may also be a need to integrate private and public transportation resources with military resources.

### **6. Infrastructure and Capacity**

Given the wide variability that exists nationwide, basic strategies and solutions must be developed to enable our hospital and medical system infrastructures to respond more effectively to mass casualty events.

Staffing issues must be addressed in advance. Plans should address multi-facility credentialing, interstate licensing agreements, and potential use of volunteers. The Health Resources and Services Administration (HRSA) is developing guidelines and standards to verify the credentials of health care professionals. When completed, the Emergency System for Advance Registration of Volunteer Health Professionals (ESAR-VHP) program will have established a network of state-owned and operated systems capable of registering and verifying the credentials of health care volunteers before an emergency. The value of registries was demonstrated in the aftermath of Hurricanes Katrina and Rita when 21 states sent more than 8,300 pre-credentialed (documented) volunteer health professionals to affected areas.

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## **7. Potential Bottlenecks**

- *Radiology*

Perhaps a minimalist approach to using radiology makes sense—identifying and standardizing a baseline that could be used in many facilities. By identifying and addressing critical life threats and major problems through “tiered” reports—initial “wet” interpretations that are made and left with/on the patient and acted on when resources become available and final reports and interpretations are completed—both patient flow and care may be greatly improved.

- *Critical Care*

Plans must be in place to provide for emergency mass critical care, including basic modes of mechanical ventilation, hemodynamic resuscitation and support using intravenous fluids and vasopressors, administration of antibiotics and other disease-specific countermeasures, and prophylactic interventions to reduce adverse consequences of critical illness. If an event exceeds a locality’s critical care/ICU capacity, hospitals must be able to activate emergency mass critical care practices, suspending usual standards of care and defining patients and interventions of highest priority.

- *Pharmacy*

Pharmacies must be prepared, and the role of pharmaceutical systems in the overall response falls into two areas:

- Selection of the proper pharmaceuticals for stockpiling, and
- Proper stockpiling of “CHEMPACKS.”

## **8. Triage**

Preparedness and response plans must recognize that there are no evidence-based standards for mass casualty events, including those that result from terrorist bombings, and that field triage often does not occur for the majority of injured victims. Response plans must account for the self-referral of patients to nearby hospitals, and the impact this phenomena may have on the care of the critically injured.

## **9. Legal Issues**

Issues related to EMTALA, HIPAA, and provider credentialing must be addressed on both a national and local level, to ensure that the emergency medical system and individual providers can respond in a timely and effective manner.

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## Addressing Discipline-specific Challenges

Our nation's health care system has a chronic problem with managing surge capacity. Providers and administrators struggle daily to provide the full spectrum of injury care for victims of trauma, placing our preparedness for terrorism in a precarious position.

This section contains nine templates developed by the expert panel to help various disciplines address issues of surge capacity. Though developed in the context of a surge of injuries from a terrorist bombing, the recommendations in this section may improve the response to and management of a surge of patients from any cause, including biological, chemical, or nuclear. Most, but not all, of these disciplines (e.g., "Drugs and Pharmaceutical Supplies" and "Nursing Care") have been discussed in the preceding sections. However these issues represent a significant concern for systems planners and therefore, the expert panel felt they must be included in the solutions section. Because many disciplines will be affected simultaneously, it is difficult, if not impossible, to identify a longitudinal timeline. For this reason, the templates are listed in a general order of flow through the system.

1. Emergency Medical Service Response
2. Emergency Department Response
3. Surgical and Intensive Care Unit Response
4. Radiology Response
5. Blood Bank Response
6. Hospitalists' Response
7. Administration Response
8. Drugs and Pharmaceutical Supplies
9. Nursing Care

Along with providing general information (i.e., purpose, background, goals), each template provides basic, and in most cases, low-cost strategies that can be implemented rapidly to avoid problems associated with managing surge capacity. The templates emphasize the importance of practicing and evaluating plans.

The templates are intended as guides only, as needs, preferences, and capabilities vary among communities. Furthermore, templates propose solutions that assume communities are already actively engaged in disaster planning and preparedness activities; therefore, it is expected that a significant portion of the personnel and resource costs would be absorbed by these ongoing activities. Exact costs should be determined by local communities and institutions therein.



#### Emergency Medical Service Response

Emergency Department Response

Surgical and Intensive Care Unit Response

Radiology Response

Blood Bank Response

Hospitalists' Response

Administration Response

Drugs and Pharmaceutical Supplies

Nursing Care

## Managing Surge Needs for Injuries: Emergency Medical Service Response

### PURPOSE

To provide guidance for local emergency medical service (EMS) response and to operationalize additional EMS-related resources needed in a community within four hours of an explosion. These resources are intended to treat 300 injured patients for up to 72 hours.

### BACKGROUND

The Madrid terrorist bombings were used as a model to help develop solutions for managing rapid surge problems during a mass casualty event.

On March 11, 2004, 10 terrorist explosions occurred almost simultaneously on commuter trains in Madrid killing 177 people instantly and injuring more than 2,000. That day, 966 patients were taken to 15 public community hospitals. More than 270 patients arrived at the closest facility between 0800 and 1030 hours.

Federal resources should not be expected to arrive sooner than 72 hours from the time of the explosion. Resources can be delayed by the time taken to deploy them and by responding to multiple communities.

### GOAL

To mobilize the appropriate number and type of EMS resources to adequately evaluate injuries, initiate triage, begin transporting 300 injured patients, and to establish ongoing EMS operations for up to 72 hours.

*This document is a resource guide. Local needs, preferences, and capabilities of affected communities may vary.*

### REQUIRED RESOURCES

1. Personnel must be:
  - Appropriately equipped and knowledgeable about chemical, biological, radiological, nuclear, and explosives (CBRNE) detection, personal protection, and decontamination.
  - Educated in the care of blast-related injuries for adult and pediatric patients.
  - Prepared to institute triage.
  - Prepared to institute and participate in unified incident command.
2. A communications system that is interoperable with public safety disciplines (fire, law enforcement, EMS, and emergency management) and with receiving hospitals and local public health officials.

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3. Rapid access to sufficient ambulance resources to transport critically injured patients.
  4. Rapid access to sufficient alternative resources (e.g., buses) to transport noncritical, injured persons.
  5. Have the necessary material and the capability to detect CBRNE agents to assist with decontamination plans.
  6. Decontamination equipment for ambulatory and non-ambulatory patients; equipment should be rapidly deployable to the explosion site, a secondary treatment site, or a hospital.
  7. Determine/implement secondary triage and treatment sites within the community.

## ASSUMPTIONS

1. EMS systems in the United States are highly variable, with a wide range of available resources, experience, and financing.
2. A functional EMS system is a critical component for planning the prehospital management of injured bombing victims.

## ACTION STEPS

1. Education:
  - Train responding EMS personnel about how to treat primary, secondary, tertiary, and quaternary blast-related injuries. For guidance, go to [www.bt.cdc.gov/masstrauma/explosions.asp](http://www.bt.cdc.gov/masstrauma/explosions.asp).
  - Train EMS personnel about National Incident Management System (NIMS) compliance; Incident Command System (ICS Homeland Security Presidential Directive 5); and the importance of command, staging, triage, and treating initial casualties (regardless of rank of the provider) should be emphasized.
  - Train EMS personnel about the use of personnel protective equipment (PPE) and the risks of transporting potentially contaminated patients. The relative importance of gross vs. technical decontamination should be reviewed.
  - Train EMS officials in advanced ICS (ICS 700 or equivalent).
2. Local policy and planning:

Fire, EMS, law enforcement, emergency management, hospitals, and public health should collaborate to develop and complete written plans within six months, as listed below. Within one year, other agencies listed in these plans (including mutual aid agencies, etc.) must be included in ongoing planning and evaluation.

  - Plan for mobilizing 50 ambulances within 10 minutes after the blast. At least 75% of these resources should arrive at staging areas in the first hour with all arriving in the first 90 minutes. This should be accomplished using 9-1-1 EMS resources, mutual aid agreements with other EMS providers, or mutual aid agreements with nonemergency transport providers.

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- Plan describing each agency's role in the command structure. This should include how critical functions of command, staging, triage, and treatment will be accomplished in the first 10 minutes of a response; how additional ICS elements will be filled over the first hour; and how the ICS structure will be formally filled by officials trained in advanced ICS (ICS-700 or equivalent) by the end of the first hour.
  - Plan describing how alternative transport for 200 ambulatory patients will be initiated in the first 10 minutes after an explosion.
  - Plan describing the details of interdisciplinary communications (primary and alternatives). Representatives from fire prevention, EMS, law enforcement, emergency management, hospitals, and public health must be included in this plan.
  - Plan for decontaminating and protecting personnel that addresses the following:
    - Agency responsible for scene assessment and determining what (if any) decontamination measures are required.
    - Realistic assessment of the time required to deploy decontamination resources for ambulatory and non-ambulatory patients.
    - Deployment of decontamination resources to event site, secondary triage sites, or receiving hospitals.
    - Transport of patients after gross decontamination (technical decontamination of patients before transport; appropriate personal protective equipment, or PPE; and appropriately equipped destination choices).
  - Plan to establish secondary triage points for ambulatory patients (ideally, within the first hour after the explosion). This should address the following:
    - How sites can be activated and staffed with at least one transport ambulance, sufficient law enforcement personnel for security, and adequate support staff to record arrivals.
    - How gross and technical decontamination could be accomplished at affected site(s).
    - How medical care at secondary triage sites could be converted to treatment areas (e.g., provision of medical supplies, additional medical personnel, and other logistical concerns).
  - Plan to establish criteria for determination of death at the scene, particularly in a mass casualty situation, and appropriately manage the deceased.

## EVALUATION

1. Plan and conduct a community-wide drill. Afterwards, evaluate it by assessing overall operations and EMS resources such as personnel, ambulances, and PPE. Evaluate compliance with NIMS.
2. Assess and refine plan.





Emergency Medical  
Service Response

Emergency Department  
Response

Surgical and Intensive  
Care Unit Response

Radiology Response

Blood Bank Response

Hospitalists' Response

Administration Response

Drugs and Pharmaceutical  
Supplies

Nursing Care

## Managing Surge Needs for Injuries: Emergency Department Response

### PURPOSE

To activate additional emergency department resources needed within four hours of an explosion. These resources should treat 300 injured patients for up to 72 hours.

### BACKGROUND

The experiences of the Madrid terrorist bombings were used as a model to help develop solutions for managing rapid surge problems during a mass casualty event.

On March 11, 2004, 10 terrorist explosions occurred almost simultaneously on commuter trains in Madrid killing 177 people instantly and injuring more than 2,000. That day, 966 patients were taken to 15 public community hospitals. More than 270 patients arrived at the closest facility between 0800 and 1030 hours.

Federal resources should not be expected to arrive sooner than 72 hours from the time of the explosion. Resources can be delayed by the time taken to deploy them and by responding to multiple communities.

### GOAL

To establish policies, procedures, didactic training, and drills to improve institutional preparedness for treating 300 injured patients for up to 72 hours.

### RESOURCES REQUIRED

There should be adequate medical, nursing, and support staff to provide initial triage, and to evaluate and stabilize 300 persons.

*This document is a resource guide. Local needs, preferences, and capabilities of affected communities may vary.*

### ASSUMPTIONS

1. Developed packets for each patient containing disaster bands (those from blood banks work best), manual charting forms, and manual lab and radiology order forms. These packets should be prepared in advance and stored in the ED.
2. Established procedures for obtaining additional personnel, equipment, supplies and beds; establish a mechanism for notifying and activating backup personnel.
3. Established procedures for triage, patient emergency identification of patients and discharge, and quick documentation.
4. Established temporary disaster log to document basic information.

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## ACTION STEPS

1. Implement and drill a hospital emergency incident command system (such as Hospital Incident Command System or “HICS”); include clinical care providers in the training and drill.

If hospital personnel (e.g., practitioners, administrators, nurses) have not trained or drilled in a hospital incident command system, learned about the National Incident Management System (NIMS), or do not understand the function of a Hospital Incident Command Center, this information should be included in training sessions.

2. Instruct clinical staff, especially surgeons and emergency physicians, about the unique aspects of blast-related injuries and care following an attack with a radiation dispersal device (RDD).
3. Establish an institutional lockdown process and drill on a regular basis; include radiation detection and decontamination of arriving patients.
4. Update the institutional call-down list and perform a functional call-down exercise.
5. Identify potential institutional surge staffing from employees with clinical training, but not currently tasked with clinical jobs.
6. Identify patient care supplies for a surge situation, such as additional IV equipment, bandages/dressings, gowns, gloves, masks, other operating room supplies, etc.
7. Develop a regional Unified Command Structure that includes local emergency management and area hospitals. This should be achieved under the guidance and leadership of the local emergency managers.
8. Identify non-patient care areas in the institution that could be converted to patient care to expand bed surge capacity.
9. Establish and drill a procedure for early patient discharge to increase bed capacity. This procedure should include evaluation of ICU patients for potential movement to a non-ICU bed and evaluation of all patients for potential early discharge or transfer to an alternative care site (internal or external to the institution).

## EVALUATION

When appropriate, evaluation drills have been incorporated into the “Action Steps” listed above. The institutional disaster preparedness plan should be updated based on each drill experience.





Emergency Medical  
Service Response

Emergency Department  
Response

Surgical and Intensive  
Care Unit Response

Radiology Response

Blood Bank Response

Hospitalists' Response

Administration Response

Drugs and Pharmaceutical  
Supplies

Nursing Care

## Managing Surge Needs for Injuries: Surgical and Intensive Care Unit Response

### PURPOSE

To mobilize and assign operating rooms and related assets for life- and limb-saving surgical care to the most critically injured of 300 patients from explosions (care extends to patients from the community with acute surgical illness for up to 72 hours after a bombing).

### BACKGROUND

The Madrid terrorist bombings were used as a model to help develop solutions for managing rapid surge problems during a mass casualty event.

On March 11, 2004, 10 terrorist explosions occurred almost simultaneously on commuter trains in Madrid killing 177 people instantly and injuring more than 2,000. That day, 966 patients were taken to 15 public community hospitals. More than 270 patients arrived at the closest facility between 0800 and 1030 hours.

Federal resources should not be expected to arrive sooner than 72 hours from the time of the explosion. Resources can be delayed by the time taken to deploy them and by responding to multiple communities.

### GOAL

Within two hours of a blast event, establish incident command for the operating rooms and surgical support areas for up to 72 hours.

### RESOURCES REQUIRED

Resources needed for communicating within the organization and with the community (e.g., satellite phone, walkie-talkie).

*This document is a resource guide. Local needs, preferences, and capabilities of affected communities may vary.*

### ASSUMPTIONS

1. Operating room (OR) assets are a critical component of surge capacity after an explosion and must be mobilized quickly.
2. The OR capacity of any institution or community (i.e., number of operating rooms) is fixed because of structural requirements.
3. One or more surgeons, anesthesiologists, and critical care specialists will be in the hospital or available immediately after an event.

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4. Other surgeons, anesthesiologists, and critical care specialists can be available within two hours of an event to provide direct patient care in the ORs and related areas.
  5. The ORs, post-anesthesia care units (PACU), and intensive care units will already be in use.
  6. Casualties of the blast and patients already in the hospital system or in other treatment centers in the community will occupy one or more of these three areas within the next 72 hours.
  7. If these areas are not made available in a timely manner, patients will suffer greater harm.
  8. Some patients could be moved to different care sites.
  9. Federal resources cannot be expected to arrive sooner than 72 hours from the time of an explosion.

## ACTION STEPS

The near-term (six months) solutions listed below include estimated hours for each task.

1. Identify medical leadership within surgery and anesthesiology for disaster planning.
  - Leadership should collaborate in the design, implementation, and refinement of an incident command system for an operating room. Initially, leadership in surgery and anesthesiology should meet with representatives from critical care, emergency medicine, administration, and others involved with the institution's disaster planning. These discussions will be facilitated by appointing a hospital disaster committee.
2. Select individuals for incident command roles.
  - Specify the authority, processes, and responsibilities of the OR incident command and a call schedule identifying individuals available to fill their roles 24 hours a day, beginning within two hours of the event, and extending for 72 hours.
  - Although individuals from several disciplines and departments in the operating room and related areas may assist the incident command, final decision-making authority should rest with one person—an "Operating Room Czar." The OR Czar would have authority to cancel scheduled OR cases, rearrange OR schedules, identify patients that could be transferred, call in and deploy OR teams, and prioritize patients for beds in the OR, PACU, and ICUs. The OR Czar would report to hospital incident command.
  - Candidates for this role should be able to assess the medical needs of a variety of patients requiring OR services. They must be physicians, and would most likely be surgeons. An individual serving in this role should not have primary patient care responsibility at the same time (i.e., be part of a surgical team).
  - Communication systems linking surgery, nursing, anesthesiology, critical care, emergency department, and hospital administration should be specified.
  - The OR incident command system must account for personnel availability at different times of the day and week and provide for transfer of incident command responsibility as the incident evolves over 72 hours.
  - The circumstances under which the OR incident command begins and ends should be specified.
  - Methods for data collection, testing, monitoring, and improving the system should be specified.

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3. Assure that individuals who might assume an incident command role are knowledgeable about incident command, operations of other hospital components, and community disaster response.

This step assures that eligible candidates for OR incident command receive appropriate training. Requirements and standards for such training should be specified.

4. Identify lines of communication and interactions with other components of the community-wide disaster plan and regional trauma system.

## EVALUATION

1. Participate in community-wide drills and evaluate performance of OR incident command.

Determine when individuals should be present onsite. Review triage decisions, quality, quantity, and appropriateness of information obtained from and given to others, including hospital incident command, emergency medicine, and other community assets.

2. Refine and conduct further planning based on drill experience.



Emergency Medical  
Service Response

Emergency Department  
Response

Surgical and Intensive  
Care Unit Response

**Radiology Response**

Blood Bank Response

Hospitalists' Response

Administration Response

Drugs and Pharmaceutical  
Supplies

Nursing Care

## Managing Surge Needs for Injuries: Radiology Response

### PURPOSE

Within four hours of an explosion, operationalize radiology support for the initial treatment of 300 injured patients and for ongoing care up to 72 hours.

### BACKGROUND

The Madrid terrorist bombings were used as a model to help develop solutions for managing rapid surge problems during a mass casualty event.

On March 11, 2004, 10 terrorist explosions occurred almost simultaneously on commuter trains in Madrid killing 177 people instantly and injuring more than 2,000. That day, 966 patients were taken to 15 public community hospitals. More than 270 patients arrived at the closest facility between 0800 and 1030 hours.

Federal resources should not be expected to arrive sooner than 72 hours from the time of the explosion. Resources can be delayed by the time taken to deploy them and by responding to multiple communities.

### GOAL

To establish policies, procedures, and drills to improve radiological preparedness for treating 300 patients injured from an explosion for up to 72 hours.

### RESOURCES REQUIRED

There must be enough radiology personnel (radiologists, technicians, and support staff), equipment, and supplies to care for 300 injured patients.

*This document is a resource guide. Local needs, preferences, and capabilities of affected communities may vary.*

### ASSUMPTIONS

1. Radiology services will be a critical component of the hospital response to a bombing.
2. Many patients over a relatively short time period requiring radiology may lead to slow-downs and bottle-necks.

### ACTION STEPS

The near-term solutions listed below include estimated number of hours needed to perform each task.

1. Develop a management plan and call list for the radiology department to use during a mass casualty event. Drill the plan, involving radiologists for

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immediate (“wet”) readings of plain films and special studies. This will assist in rapid evaluation and treatment of patients. The plan should also optimize and streamline radiology study protocols for use during a mass casualty event.

Enhanced radiology patient throughput will be essential in the initial evaluation and treatment of blast-injuries. Each radiology department must develop a plan to ensure rapid turnaround of patient studies and their results.

2. When disaster patients arrive, a radiology ultrasound technician should be available in the emergency department to support the performance of an immediate FAST (Focused Abdominal Sonography for Trauma) exam. If this is not possible, the emergency physicians and trauma surgeons should be trained to conduct one.
3. Conduct an imaging equipment survey; evaluate the status of the equipment for multiple traumas, making sure there are adequate amounts of portable equipment available and update if needed.

Radiology equipment is expensive and usually requires planning in advance for acquisition and installation. However, by evaluating how available equipment could be put to maximum use during a mass casualty event can improve patient throughput.

4. Establish a protocol for augmenting patient movement and monitoring in the radiology department. Afterwards, review the availability of patient monitoring personnel and equipment to enhance departmental throughput, especially for studies such as CT scans.

## EVALUATION

Where appropriate, evaluation drills have been incorporated into the “Action Steps” listed above. The institutional disaster preparedness plan should be updated based on each drill experience.



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Nursing Care

## Managing Surge Needs for Injuries: Blood Bank Response

### PURPOSE

Within four hours of an event, provide blood products for up to 300 injured patients and sustain support for up to 72 hours.

### BACKGROUND

The Madrid terrorist bombings were used as a model to help develop solutions for managing rapid surge problems during a mass casualty event.

On March 11, 2004, 10 terrorist explosions occurred almost simultaneously on commuter trains in Madrid killing 177 people instantly and injuring more than 2,000. That day, 966 patients were taken to 15 public community hospitals. More than 270 patients arrived at the closest facility between 0800 and 1030 hours.

Federal resources should not be expected to arrive sooner than 72 hours from the time of the explosion. Resources can be delayed by the time taken to deploy them and by responding to multiple communities.

### GOAL

During the first four hours of a disaster, ensure that that appropriate blood products can be located, processed, and quickly administered to at least 300 patients requiring transfusions. Identify additional needs so that blood products can be collected, processed, and administered for up to 72 hours.

### RESOURCES REQUIRED

- AABB documents
- Disaster response plans for hospital and blood collection centers
- Laboratory personnel to collect, process, and distribute products
- Transportation resources, diesel and unleaded fuel, and storage equipment (e.g., dry ice)
- Transfusion supplies

*This document is a resource guide. Local needs, preferences, and capabilities of affected communities may vary.*

### ASSUMPTIONS

- The most difficult problems involve disruption or interference of the blood supply system
  - Historically, blood supply needs during disaster response have been met with the quantity of blood products available at that time.

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- Facilities currently maintain about a three-day supply of blood products—which may need to be expanded to a seven-day supply.
  - Typically, fewer casualties require blood products than the total number of victims.
  - Local communities have limited sources of blood products.
  - If faced with a surge in demand, blood products will likely be transported from blood centers outside the local area.
  - After a disaster, the public usually responds by volunteering to donate larger quantities of blood products than are needed.
    - An influx of blood donors could tax collecting and processing efforts.
    - When resources (personnel, equipment, and supplies) are unnecessarily applied to collecting and processing unneeded products, these resources cannot process and distribute available and urgently needed products to those in urgent need.
  - The media must continuously provide the community with reliable information about the need and supply of blood products.
  - There are limited personnel with the training, education, and skills to process and administer blood products within treating facilities.
    - Additional qualified laboratory personnel may be needed to process requests for blood products.
    - Additional nursing personnel may be needed to administer blood products.
  - There may be limited methods of transporting or transferring blood products from supplier to destination during a disaster.
    - Commercial transport (air and ground) may be limited.
    - Blood needs are considered by federal, state, and local governments to be a critical element of the public health infrastructure in times of emergency.
  - The AABB Interorganizational Task Force on Domestic Disasters and Acts of Terrorism, formed in January 2002, has developed a process to educate the community about donations and how to collect, process, and move blood products at the time of a disaster.
    - This multi-organizational task force includes federal and national organizations.
    - Published references include a Disaster Operations Handbook and a hospital supplement that addresses these issues. They include a flow chart outlining the process for involving the AABB and appropriate national and federal organizations that provide blood products during a disaster.

## ACTION STEPS

- Work with AABB to distribute documents to hospitals and blood collection organizations/facilities.
- Identify resources (personnel, equipment, supplies) to meet local needs for collection, processing, distribution, and transfusion of blood products. This effort must include local media to provide consistent messages to the community about blood products, supply, and needs. (Note: Individual hospitals and collection organizations incorporate the AABB process into their local disaster response plans.)

- 
- Work with other organizations and government agencies (local, regional, state, federal) to make sure blood products are considered critical elements of the public health infrastructure in the event of a disaster/emergency.

## EVALUATION

- Ensure that survey hospitals and collection organizations incorporate AABB processes into local disaster response plans after 4 to 6 months.
- Request that hospitals and collection organizations participate in a local or regional exercise requiring administration of blood products within four hours of an event for up to 72 hours.
  - Include activation and response of the AABB system, and local, regional, and state resources in the exercise.





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## Managing Surge Needs for Injuries: Hospitalists' Response

### PURPOSE

Within four hours, leverage the knowledge and skills of hospitalists to treat 300 patients injured from explosions and to sustain care for 72 hours.

### BACKGROUND

The Madrid terrorist bombings were used as a model to help develop solutions for managing rapid surge problems during a mass casualty event.

On March 11, 2004, 10 terrorist explosions occurred almost simultaneously on commuter trains in Madrid killing 177 people instantly and injuring more than 2,000. That day, 966 patients were taken to 15 public community hospitals. More than 270 patients arrived at the closest facility between 0800 and 1030 hours.

Federal resources should not be expected to arrive sooner than 72 hours from the time of the explosion. Resources can be delayed by the time taken to deploy them and by responding to multiple communities.

### GOAL

Within four hours of an explosion, deploy staff and functioning beds to treat at least 300 injured patients who require acute inpatient and intensive care for 72 hours.

The boldfaced terms have the following meaning:

- **deploy** – represents the sum of the following:
  - redefine (standards of care)
  - reallocate (on-site staff)
  - recruit (off-site staff)
- **functioning** - represents the sum of the following:
  - supplied (items necessary for care are available)
  - serviced (patients with assigned caregivers, available clinical support services such as laboratory, radiology, and pharmacy)
  - stepped-down (patients capable of being transferred from ICU but in need of close monitoring)

### RESOURCES REQUIRED

1. The general public's and health care communities' education and acceptance of the concept and need for altered standards of care during a large-scale disaster response.

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2. Adequate staffing to support response efforts (physicians, nurses, technicians, support staff, supplies, and equipment).
  3. Mechanism to implement an altered standard of care. This should include ways to rapidly “step down” suitable patients (e.g., from ICU to floor and from floor to elsewhere)
  4. Mechanism within hospitals that place hospitalists into “real-time” roles that enable them to allocate and ration resources and to serve as advisors to and outreach arms of Incident Command.

*This document is a resource guide. Local needs, preferences, and capabilities of affected communities may vary.*

## ASSUMPTIONS

1. Effective clinical response to a surge of patients from a bombing event will require coordination and cooperation among multiple medical specialties.
2. Hospitalists will be an integral component in identifying available hospital beds, discharging patients, caring for patients, and providing additional support during the response.

## ACTION STEPS

1. Develop and disseminate an alternate standard-of-care policy for use during a disaster situation. Include in-hospital triage for alternate levels of care, early transfer to lower levels of care, and early discharge. Consider using the Agency for Healthcare Research and Quality document as a reference.
2. Convene ethics panel as necessary. Enlist Society of Hospital Medicine (SHM) Ethics Committee as needed.
3. Educate appropriate staff about the alternate standard of care policy.
4. Ensure that hospitalists are incorporated into the disaster response of each hospital to address issues related to effective preparedness and response.

## EVALUATION

1. Conduct an exercise that implements the alternate standard of care policy and uses hospitals as designated in the disaster plan.
2. Critique the exercise against the response plan; emphasize issues about alternate standards of care and performance of hospitalists.
3. Revise the alternate standard of care policy and disaster plan based on the outcome of the exercise.



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## Managing Surge Needs for Injuries: Administration Response

### PURPOSE

Within four hours, operationalize additional administrative-related resources to treat 300 patients injured from an explosion and sustain care for 72 hours.

### BACKGROUND

The experiences of the Madrid terrorist bombings were used as a model to help develop solutions for managing rapid surge problems during a mass casualty event.

On March 11, 2004, 10 terrorist explosions occurred almost simultaneously on commuter trains in Madrid killing 177 people instantly and injuring more than 2,000. That day, 966 patients were taken to 15 public community hospitals. More than 270 patients arrived at the closest facility between 0800 and 1030 hours.

Federal resources should not be expected to arrive sooner than 72 hours from the time of the explosion. Resources can be delayed by the time taken to deploy them and by responding to multiple communities.

### GOAL

To organize and support response to influx of 300 patients injured from an explosion for a 72-hour period.

### RESOURCES REQUIRED

The workload associated with an administrative response will require access to multiple facilities to support the needs of patients, staff, and the general public. Administrators will manage communications, acquire political support, work with and respond to media, handle public inquiries, manage internal systems and departments.

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### ASSUMPTIONS

- Health care systems and hospitals should function as an integrated system for the best use of resources.
- A medical response to a mass casualty event must be comprehensive, community based, and coordinated.
- Legal and regulatory issues need to be included in the hospital emergency preparedness plan: Emergency Medical Treatment and Active Labor Act

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(EMTALA), Health Insurance Portability and Accountability Act (HIPAA), Federal Volunteer Protection Act, Good Samaritan Laws, labor laws, OSHA, and facility codes.

- Activating the community Emergency Operations Center (EOC) and hospital's command center are critical to success.
- Communication among hospitals, health systems, EMS, EOC, and public health cannot be lost or interrupted.
- Hospitals use the incident command system and have staff who can implement it.
- Hospitals, long-term care facilities, offices, and clinics have Memoranda of Understanding (MOU) to share resources.
- The EOC includes health care representatives to coordinate medical resources.
- Patients who do not need acute care services should be treated at alternate care facilities.
- The institution must:
  - Establish a response plan based on the Incident Management System (e.g., Hospital Incident Command System (HICS) model).
  - Include clinics and offices with emergency preparedness plans consistent with the hospital.
  - Include medical, nursing, dental, and pharmacy staff; respiratory students; and house staff and fellows, if available.
  - Determine the location of the command center (not in the ED) and backup sites.
  - Establish written plans to secure the perimeter of the facility and access points.
  - Identify a spokesperson for the hospital (public information officer).
- The preparedness plan should include mechanisms for modifying admission, discharge, and procedure schedules.
  - Defer admissions that are not emergent (develop criteria and put into policy).
  - Notify operating room manager to defer or cancel inpatient and outpatient non-emergency surgeries.
- Incorporate intensivist, hospitalist, or Chief of Staff's designee into plan for discharging patients during emergency operations. (See template on Hospitalist Response) Set up MOUs with hospitals.

Additional staffing issues to consider:

- Have available staff address the mental health of victims, families, and staff (e.g., psychiatrists, psychologists, licensed mental health practitioners, and volunteers).
- Employ workers trained by the American Red Cross, especially those who can provide mental health services.
- Provide child care services so that staff are free to attend to patients.
- Compile a list of qualified translators for the disaster.

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## ACTION STEPS

The solutions listed below include estimated hours for each task.

### 1. Control of the External Environment

The external environment will change rapidly during a large-scale, mass casualty event. The hospital must be secured and campus traffic must be controlled. Such control of the external environment includes clearing beds to accommodate incoming casualties, redirecting non-emergency patients to other resources, and managing the comings and goings of staff. Managing media relations can be challenging when trying to provide safe and effective care. The institution's security and public affairs offices must work together and be in place before the media arrives.

### 2. Activation of Hospital Incident Command System (HICS)

HICS, a widely used emergency management system, is known for providing a chain of command with the ability to effectively manage an incident, provide accountability of position functions, allow for a flexible response to specific emergencies, improve documentation of facility actions, provide a common language to facilitate outside assistance, and develop prioritized response checklists for senior leadership. Identifying the appropriate people to make decisions is pivotal in a fast-paced disaster, such as in the Madrid bombings. There is little time for meetings and discussion about the appropriate use of support functions and personnel. Staff should be trained and drilled regularly to ingrain the difference between incident structure and normal operations.

### 3. Logistics and Supplies

Coordinating with key suppliers and maintaining current inventories throughout the health system will make stocking efforts easier. When resources are limited, providers must be prepared to respond to care needs with whatever is available.

Logistics include, but are not limited to, patient transportation. For example, housing evacuees and the walking wounded and their families is a function of the emergency management program. Knowing the locations of designated shelters throughout the vicinity and transportation resources for low-acuity patients and their families will hasten discharge planning and patient flow in acute care facilities.

### 4. Alternate Care Sites

A hospital's ability to mobilize emergency care units and to extend care to the city's walking wounded adds to its effectiveness. Triage systems are used to prioritize patients so that low-priority patients can be directed from the main hospital, allowing ambulances and hospital staff to focus on high-priority trauma patients in need of medical assistance. Alternate sites, like the ones used during Hurricanes Katrina and Rita, allow large health systems to facilitate triage and direct patients to appropriate sources of care.

### 5. Credentialing

The Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) emergency credentialing system must be tested within an organization before it is really needed. State Emergency Systems for Advance Registration of Volunteer Health Professionals (ESAR-VHP) reflect JCAHO requirements and provide a standardized set of verified credentials for volunteers who may be called to assist hospitals during emergency situations.

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## **6. Patient Tracking**

Successful patient tracking begins as soon as they enter the health care system. When more time is spent identifying and tracking patients, the prospect of reimbursement for related costs is better. The ability to track patients, identify their supply consumption, and monitor bed use enables senior management to proactively meet the needs of health care providers on the frontline. Patient tracking systems must be flexible enough to accommodate such needs.

## **7. Identify gaps**

- Ensure coordination between on-scene management and available community resources so that specific facilities are not overloaded.
- Communication among facilities at clinical and administrative levels is essential.

## **8. Identify additional sources of community support**

Additional sources of support can include local shelters, locally-developed stockpiles, community pharmacies, drug wholesalers/warehouses, public health authorities, etc. Access to these resources will be important if the event displaces many residents due to contamination, property damage, utility failure, etc.

## **9. Establish communication and relationships**

- Develop communications with local emergency management.
- Establish communications with local, regional, and state hospitals.

## **10. Exercise plans**

- Establish regular schedules to drill every aspect of a response to ensure that all staff understands their roles.
- Evaluate the drills, and modify plans based on after-action reports.
- Drill the new plan.

## **EVALUATION**

1. Plan, conduct, and evaluate facility-wide drills. The evaluation should identify stressors on clinical and administrative activities.
2. Plan, conduct, and evaluate community-wide drills. The evaluation should identify stressors on clinical and administrative activities.





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## Managing Surge Needs for Injuries: Drugs and Pharmaceutical Supplies

### PURPOSE

Within four hours of an explosion, acquire the additional drugs and pharmaceutical supplies needed to treat 300 injured patients for up to 72 hours.

### BACKGROUND

The Madrid terrorist bombings were used as a model to help develop solutions for managing rapid surge problems during a mass casualty event.

On March 11, 2004, 10 terrorist explosions occurred almost simultaneously on commuter trains in Madrid killing 177 people instantly and injuring more than 2,000. That day, 966 patients were taken to 15 public community hospitals. More than 270 patients arrived at the closest facility between 0800 and 1030 hours.

Federal resources should not be expected to arrive sooner than 72 hours from the time of the explosion. Resources can be delayed by the time taken to deploy them and by responding to multiple communities.

### GOAL

Within four hours of an explosion, acquire appropriate and adequate drugs to treat 300 injured patients for up to 72 hours.

### RESOURCES REQUIRED

The list below includes therapeutic categories, administration route, and recommended drug or pharmaceutical supply. For simplicity, purchase and stockpile a single or few drugs from each therapeutic category. Care providers may have little or no prior experience with a drug.

*This document is a resource guide. Local needs, preferences, and capabilities of the affected communities may vary.*

- Analgesics  
p.o., hydrocodone/acetaminophen (one strength—5/500); IV, morphine
- Anxiolytics  
p.o. and IV, lorazepam
- Antipsychotics  
p.o. and IV, haloperidol
- Antibiotics, broad spectrum with low allergy risk  
p.o. and IV, ciprofloxacin

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- Intravenous fluids  
saline and D5W
  - Blood (see Blood Bank Response)
  - Drugs for intubation  
IV etomidate, succinylcholine, and vecuronium
  - Topical burn care agents  
Silver sulfadiazine (Silvadene)  
Bacitracin
  - ENT meds for TM perforation  
Cortisporin otic suspension
  - Ocular meds  
Proparacaine  
Erythromycin ophthalmic ointment
  - Tetanus toxoid

### ASSUMPTIONS

1. There may be a demand for certain pharmaceuticals following a bombing event with multiple casualties.

### ACTION STEPS

1. Identify community medical leadership and a committee to address near-term solutions.  
Discussion and decision by EMS, emergency medicine, trauma surgery, hospital pharmacy (PharmD), blood bank, hospital leadership, hospital nursing, emergency management, public health, and law enforcement about transport of pharmaceuticals.
2. Inventory drugs and quantities available at points of care (prehospital and hospital).  
Assuming 4 hospitals and 10 ambulances, committee should delegate a point person to contact hospital pharmacists and EMS leadership and inquire about inventory.
3. Identify gaps between drugs on hand and goal.
4. Identify potential sources of drugs in the community besides prehospital and hospital supplies (e.g., locally developed stockpiles, community pharmacies, drug wholesalers/warehouses, physicians' offices via medical society). Identifying additional sources should include daily, routine needs of the community.
5. Develop relationships with leadership from additional sources; ask for "snapshot" inventory of drugs, and establish "mutual aid" agreements to rapidly acquire drugs.
6. Assess drugs available in the community by adding prehospital + hospital + community pharmacies + drug wholesalers/warehouses + physicians' offices (through medical society).
7. If the drug supply is low, develop a plan for intercommunity mutual aid or rationing.

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8. Develop a plan to rapidly acquire drugs from additional sources and deliver products to points of care. This plan should include communications between point(s) of care and additional sources, mutual aid agreements with additional community sources, transport of drugs, and reimbursement.

## EVALUATION

1. Plan, conduct, and evaluate a community-wide drill. The evaluation should include measuring quantity and names of drugs and pharmaceutical supplies acquired, distributed and administered; times when drill started, time drugs were acquired from distribution points, duration of transport, time of distribution to points of care, and time of administration to patients.
2. Refine plan based on drill experience.

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## Managing Surge Needs for Injuries: Nursing Care



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### PURPOSE

To operationalize additional nursing resources in a community within four hours of a terrorist bomb explosion and to treat 300 injured patients for up to 72 hours.

### BACKGROUND

The experiences of the Madrid terrorist bombings were used as a model to help develop solutions for managing rapid surge problems during a mass casualty event.

On March 11, 2004, 10 terrorist explosions occurred almost simultaneously on commuter trains in Madrid killing 177 people instantly and injuring more than 2,000. That day, 966 patients were taken to 15 public community hospitals. More than 270 patients arrived at the closest facility between 0800 and 1030 hours.

Federal resources should not be expected to arrive sooner than 72 hours from the time of the explosion. Resources can be delayed by the time taken to deploy them and by responding to multiple communities.

### GOAL

Within four hours of an explosion, mobilize the appropriate number of facilities and beds, nursing staff, and resources needed to treat 300 injured patients for up to 72 hours.

### RESOURCES REQUIRED

The workload will require adequate staffing and backup personnel for the initial response, and mechanisms for notification and activation, credentialing volunteers, and for ensuring the safety and welfare of responders.

*This document is a resource guide. Local needs, preferences, and capabilities of affected communities may vary.*

### ASSUMPTIONS

1. Nursing personnel are essential for an effective response to a bombing, including patient care, patient tracking and information management, and logistical support.

### ACTION STEPS

The solutions listed below involve providing clinical nursing for 300 patients over a 72-hour period.

- Make all physical beds available for care, including those in storage and those that can be rented on short notice. Place cots in rooms or hallways.

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- Develop criteria and policy to discharge patients who can go home or be quickly transferred to long-term care.
    - Make sure each department has a procedure for mass casualty care. These procedures need to be reviewed and be accessible to the command center.
    - Departments need to determine procedures for what will be done immediately (0–120 minutes), intermediately (2–4 hours) and long term (4–24 hours).
  - Notify all departments of incident and of emergency plan activation.
  - Request that policies be approved by a centralized committee that oversees the emergency operations and plan.
  - Update call lists. Every department should have a current list that identifies staff by their proximity to the hospital.
  - Make staff aware of where to park, where to report, how to respond, etc.
  - Maintain a centralized data base with staff competency skills like ACLS (Advanced Cardiac Life Support®), TNCC (Trauma Nurse Core Course), ENPC (Emergency Nurse Pediatric Course), and PALS. Identify who is competent to care for critically ill patients.
  - Add on-call staff to the disaster call list.
  - Maintain names of retired or unemployed staff in a hospital or health system database.
  - Include Medical Reserve Corp information/lists in the emergency response plan.
  - Prepare badges in advance for credentialed professional staff.
  - Credential volunteers in advance. Community agencies typically manage volunteers.
  - Set up a system so that the hospital can verify credentials (i.e., State ESAR-VHP).
  - Ensure that staff is assigned to tasks with which they are most familiar and perform daily; do not change routine procedures.

## EVALUATION

Hospitals/health systems should plan and execute a drill with EMS at least once a year. The drill should include objectives to accommodate 300 patients with beds, staffing, and resources.

Critique the completed drill, write a report, and share the findings with participants. Hospital administrators should analyze the report and make recommendations to the disaster plan. Any deficiencies should be tested in the next drill.

Planning a drill is expensive. Exercises must be done in conjunction with state or county/city emergency management agency staff with the resources to conduct them.

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## Conclusion

Worldwide bombings occur almost daily and are escalating in complexity and sophistication. As noted throughout this report, we know the U.S. health care system will be overwhelmed by a terrorist bombing. The proposed solutions outlined in this report, provide strategies that can be put in place now—before a crisis strikes—to address the system wide and discipline-specific surge capacity challenges to providing an effective response.

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## References

1. Patterns of global terrorism 2001. United States Department of State. [online] May 2002 [cited 2005 Feb 4]. Available from: URL: [www.state.gov/documents/organization/10319.pdf](http://www.state.gov/documents/organization/10319.pdf).
2. Patterns of global terrorism 2002. United States Department of State [online] April 2003 [cited 2005 Feb 4]. Available from: URL: [www.state.gov/documents/organization/20177.pdf](http://www.state.gov/documents/organization/20177.pdf).
3. Patterns of global terrorism 2003. United States Department of State [online] April 2004 [cited 2005 Feb 4]. Available from: URL: [www.state.gov/documents/organization/31912.pdf](http://www.state.gov/documents/organization/31912.pdf).
4. Terrorism 2000/2001. United States Department of Justice, Federal Bureau of Investigation (FBI), Counterterrorism Division. Publication #0308 [FBI website] [cited 2005 Feb 4]. Available from: URL: [www.fbi.gov/publications/terror/terror2000\\_2001.htm](http://www.fbi.gov/publications/terror/terror2000_2001.htm).
5. Gadson LO, Michael ML, Walsh N, editors. FBI Bomb Data Center: 1998 bombing incidents. Washington (DC): Department of Justice (US), Federal Bureau of Investigation; 1998. General Information Bulletin 98-1.
6. Terrorism Research Center, Inc. Available at: URL: [www.Terrorism.com](http://www.Terrorism.com).
7. Cushman JG, Pachter HL, Beaton HL. Two New York City hospitals' surgical response to the September 11, 2001, terrorist attack in New York City. *J Trauma* 2003;54(1):147-55.
8. Rodoplu U, Arnold JL, Yucel T, Tokyay R, Ersoy G, Cetiner S. Impact of the terrorist bombings of the Hong Kong Shanghai Bank Corporation headquarters and the British Consulate on two hospitals in Istanbul, Turkey, in November 2003. *J Trauma* 2005;59(1):195-201.
9. Frykberg ER. Terrorist bombings in Madrid. *Critical Care* 2005;9:20-2.
10. Frykberg ER. Medical management of disasters and mass casualties from terrorist bombings: how can we cope? *J Trauma* 2002;53:201-12.
11. Frykberg ER, Tepas JJ. Terrorist bombings: lessons learned from Belfast to Beirut. *Ann Surg* 1988;208:569-76.
12. National Strategy for Combating Terrorism. United States Government, 2003. Available at: URL: [http://www.whitehouse.gov/news/releases/2003/02/counter\\_terrorism/counter\\_terrorism\\_strategy.pdf#search=%22national%20strategy%20for%20combating%20terrorism%22](http://www.whitehouse.gov/news/releases/2003/02/counter_terrorism/counter_terrorism_strategy.pdf#search=%22national%20strategy%20for%20combating%20terrorism%22).
13. Lesser IO, Hoffman B, Arquilla J, Ronfeldt DF, Zanini M, Jenkins BM, editors. Countering the new terrorism. Santa Monica (CA): RAND Corporation; 1999.
14. Gutierrez de Ceballos JP, Turegano Fuentes F, Perez Diaz D, Sanz Sanchez M, Martin Llorente C, Guerrero Sanz JE. Casualties treated at the closest hospital in the Madrid, March 11, terrorist bombings. *Crit Care Med* 2005;33(1 Suppl):S107-12.
15. Bazerman MH, Watkins MD. Predictable surprises: the disasters you should have seen coming, and how to prevent them (leadership for the common good). Boston (MA): Harvard Business School Press; 2004.

- 
16. Burt CW and McCraig LF. Staffing, Capacity, and Ambulance Diversion in Emergency Departments: United States, 2003–04. Advance data from vital and health statistics; September 27, 2006; 376.
  17. Visits to U.S. emergency departments at all-time high; number of departments shrinking [online press release] 26 May 2005 [cited 10 Apr 2006]. Atlanta (GA): Centers for Disease Control and Prevention, Office of Enterprise Communication, Media Relations. Available from: URL: [www.cdc.gov/od/oc/media/pressrel/r050526.htm](http://www.cdc.gov/od/oc/media/pressrel/r050526.htm).
  18. American College of Emergency Physicians. Ambulance diversion and ED overcrowding. Available from: URL: [www.acep.org/webportal/PatientsConsumers/critissues/overcrowding/FactSheetAmbulanceDiversionandE.htm](http://www.acep.org/webportal/PatientsConsumers/critissues/overcrowding/FactSheetAmbulanceDiversionandE.htm). Cited 12 October 2006.
  19. Derlet RW, Richards JR. Overcrowding in the nation's emergency departments: complex causes and disturbing effects. *Ann Emerg Med* 2000;35(1):63–8
  20. Eckstein M, Isaacs SM, Slovis CM, Kaufman BJ, Loflin JR, O'Connor RE, et al. Facilitating EMS turnaround intervals at hospitals in the face of receiving facility overcrowding. *Prehosp Emerg Care*. 2005 Jul-Sep;9(3):267-75.
  21. Schafermeyer RW, Asplin BR. Hospital and emergency department crowding in the United States. *Emerg Med (Fremantle)* 2003;15(1):22–7.
  22. General Accounting Office (US), Hospital emergency departments: crowded conditions vary among hospitals and communities. Washington (DC): Government Printing Office; 14 Mar 2003. Report No.: GAO-03-460.
  23. American Hospital Association, Prepared to Care: The 24/7 role of America's full-service hospitals. 2006. Cited 12 October 2006. <http://www.aha.org/aha/content/2006/pdf/PreparedToCareFinal.pdf> Available from: URL: <http://www.aha.org/aha/content/2006/pdf/PreparedToCareFinal.pdf> (3 February 2004).
  24. Institute of Medicine (US), Committee on the Future of Emergency Care in the United States Health System. Future of emergency care, emergency medical services: at the crossroads. Washington (DC): The National Academies Press; 2006.
  25. Institute of Medicine (US), Committee on the Future of Emergency Care in the United States Health System. Future of emergency care, hospital-based emergency care: at the breaking point. Washington (DC): The National Academies Press; 2006.
  26. Institute of Medicine (US), Committee on the Future of Emergency Care in the United States Health System. Future of emergency care, Emergency care for children: growing pains. Washington (DC): The National Academies Press; 2006.
  27. Niska RW, Burt CW. Bioterrorism and mass casualty preparedness in hospitals: United States, 2003. Advance data from vital and health statistics; National Center for Health Statistics; September 27, 2005: 364.
  28. Auf der Heide E. The importance of evidence-based disaster planning. *Ann Emerg Med* 2006. Jan; 47(1):34–49.

- 
29. Robinson L, Nuzzo JB, Talmor DS, O'Toole T, Kramer BR, Inglesby TV. Augmentation of hospital critical care capacity after attacks or epidemics: recommendations of the Working Group on Emergency Mass Critical Care. *Crit Care Med* 2005; 33:10 (Suppl).
  30. Schmidt PJ. Blood and disaster—supply and demand. *N Engl J Med* 2002;346(8):617–20.
  31. Disaster operations handbook, coordinating the nation's blood supply during disasters and biological events. American Association of Blood Banks. Available from: URL: [www.aabb.org/Documents/Programs\\_and\\_Services/Disaster\\_Response/dohdbk030503.pdf](http://www.aabb.org/Documents/Programs_and_Services/Disaster_Response/dohdbk030503.pdf)
  32. Disaster operations handbook, overview of response plan. American Association of Blood Banks. Available from: URL: [www.aabb.org/Documents/Programs\\_and\\_Services/Disaster\\_Response/dohdbkoview030503.pdf](http://www.aabb.org/Documents/Programs_and_Services/Disaster_Response/dohdbkoview030503.pdf)
  33. Disaster operations handbook—hospital supplement, coordinating the nation's blood supply during disasters and biological events. American Association of Blood Banks. Available from: URL: [www.aabb.org/Documents/Programs\\_and\\_Services/Disaster\\_Response/dohdbksupp030503.pdf](http://www.aabb.org/Documents/Programs_and_Services/Disaster_Response/dohdbksupp030503.pdf)
  34. Agency for Healthcare Research and Quality. Altered standards of care in mass casualty events. Rockville (MD): Department of Health and Human Services (US). Prepared by Health Systems Research Inc.; 2005. Contract No.: 290-04-0010. AHRQ Publication No. 05-0043. Available from: URL: [www.ahrq.gov/research/altstand/altstand.pdf](http://www.ahrq.gov/research/altstand/altstand.pdf).